Is There a Tower in Your Future?

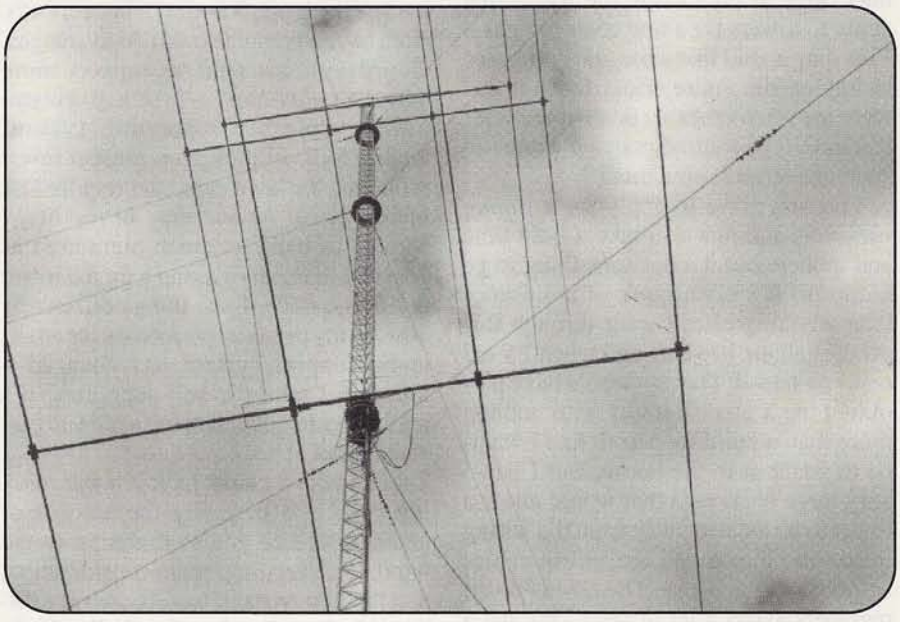
The longer you're a ham and the more involved you get in the hobby, the more likely it is that you'll want to put up a tower. Here are some basic things you should know.

Years ago, I wanted a job with a Motorola repair shop, so I lied. Oh, I had all the credentials that you could get from books, soldering irons, and the FCC. There was no problem there. What I lied about was my experience climbing towers—I had none, but I claimed to have climbed everything. Worse, I had a phobia about heights.

The first day on the job I was sent out with another service tech to replace an antenna on a 150-foot tower. Dan, the other tech, made no bones about it: He did NOT climb towers. It was a long ride out of town to the tower site. Time seemed to pass very slowly as we drove. Once there, I pretended to know what I was doing. Finally, there was nothing left to do but climb.

I got about 50 feet up—it seemed like 10 miles—and then something really interesting happened. I "froze" to the tower. Now, time started to pass really slowly. I continued to breathe and my heart was beating, but nothing else worked. I was totally rigid. You could have suspended me between a couple of chairs and walked on me like they do on the hypnosis stage shows. Finally, Dan noticed that there was something wrong and called up to me "Are you all right?"

"Sure," I said. But inside I knew it was a lie. Here we were 30 miles out of town on a hillside where only the four-legged live. Dan didn't climb, so he couldn't help me. Besides, if I asked for help, I would be admitting that I lied about my experience. And I really needed to keep that job. What could I do?



An example of a guyed tower (this one happens to have HF antennas on it). The higher the tower, the more guy wires it needs. This tower has three sets of guys.

Ahh, Towers...

Towers! Who would want to climb one? Who would want to own one? Hams, that's who! What else can bring so much joy to the heart of the ham and so much terror to the eyes of the spouse, neighbors, and city fathers? Towers epitomize the old saw, "beauty is in the eye of the beholder." Nectar of the gods or concentrated rat poison—there's no in between.

Why do we want to put up towers? What's the big benefit? It's simple: height means increased range and coverage, particularly when talking about VHF/UHF communications. Not only does a tower give an antenna height, it gets the antenna away from objects that might distort its radiation pattern. And for those bands that might be involved in TVI, it gets the antenna farther away from house wiring and other unintentional RF paths. All that said, a tower may or may not be worth the cost and effort. It all depends on your particular circumstances, the first of which is what the rules are where you live.

Know Your Zoning Laws

Most of us live within the limits of some municipality, which means that we have to contend with zoning rules and regulations. You could simply ignore the authorities and their rules, but I wouldn't advise that course of action. What are the zoning rules for your community? It may be that your community has some reasonable rules on the books, then again, maybe not. Regardless, you need to know the rules if you want to put up a tower, or, as it's known in "zoning-speak," an *antenna support structure.*

By Peter O'Dell, WB2D

"I 'froze' to the tower...I continued to breathe and my heart was beating, but nothing else worked. I was totally rigid."

Dale Clift, NA1L, is an attorney and expert on zoning issues. He advises that you should always get a *complete* copy of your town's zoning rules. It will probably cost you $10 to $25, but starting out with the complete book could save you a lot of time and trouble later on. If you simply go into your local city hall, the clerk may offer to photocopy the pages that apply to towers for a few cents per page. This may sound like a bargain compared to buying the entire book, but beware: there are often other sections of the rules that modify or contradict specific rules on "antenna support structures."

You may have to apply for a *zoning variance*, and that will take a little time and money, but it's not something to be afraid of. It's often more of a nuisance than anything else. I went through this process about 10 years ago when I lived on Long Island. The city would have permitted me a modest tower with nothing more than a building permit had I wanted to attach it to the house. But I had a very large back yard that would allow a tower to be located away from the wiring inside the house and the utility cables coming into the house. The zoning board members asked a lot of questions and a couple of neighbors complained, but, a few weeks later, I had my permit. Of course, not everyone is so lucky, and those are the cases we're likely to hear about.

Circumstances vary too much from one situation to another to make any blanket pronouncements. You may or may not need an attorney to help you secure a variance. The best way to start is to contact the ARRL and ask for its information kit on towers and zoning issues (the "PRB-1 kit"). By the way, someone will probably tell you that the FCC, through PRB-1, has preempted local government's ability to deny you a permit. Not so. PRB-1 is a great help to the ham looking to challenge overly restrictive ordinances, but it's not a panacea.* There's no way around it, you're going to have to do your homework. Still interested in putting up a tower? I know—just testing.

* "PRB-1" was a 1985 FCC ruling that local zoning rules must "reasonably accommodate" amateur radio operation. Interpretations of what constitutes "reasonable accommodation" have varied widely. The essence of the ruling was later incorporated into Part 97 of the FCC rules, in section 97.15(e), which states, in part, "State and local regulation of a station antenna structure must not preclude amateur service communications. Rather, it must reasonably accommodate such communications and must constitute the minimum practicable regulation to accomplish the state or local authority's legitimate purpose."

To Guy or Not to Guy?

There are basically two general types of tower: guyed and self-supporting systems. Which one is better? That depends. Both have advantages and disadvantages. Guyed systems tend to support more antenna (*wind-loading*) for a given size tower, while self-supporting systems tend to look a lot cleaner, present fewer problems for lawn care, and require less maintenance. At one time in my life, I wanted to hang as much aluminum as possible in the air making a guyed tower my best choice. I see things differently now, so my personal preference for an antenna support system has changed—today, I'd take the self-supporter. It's really a matter of balancing need and personal taste.

Let's take a closer look at *wind loading,* which is basically the amount of antenna surface you're exposing to the wind. It's a *very* important consideration, and the two types of towers are very different in how they handle windloading.

Take a look at Figure 1. The antenna on top of the tower is functioning like a sail on a ship. If you've never actually been on a sailing vessel, it can surprise you just how much force the wind can develop and how strongly it will blow a boat along. Great for sailing, but lousy for radio towers. Think of the antenna as a sail and the tower as a boat that's anchored down.

What happens to the force of the wind as it blows against the tower and antenna? In a guyed system, the guy wires prevent the tower from moving, which causes the horizontal force of the wind to be converted into a downward pressure passing through the tower into the concrete base of the tower. The net effect is that the wind is literally trying to push the tower down into the ground. (Incidentally, when guyed towers do come down, their sections tend to collapse like an accordion, instead of falling out in a straight line. That's why tower manufacturers specify so many sets of guy wires for a given tower height. The higher the tower you put up, the more sets of guy wires you'll need.)

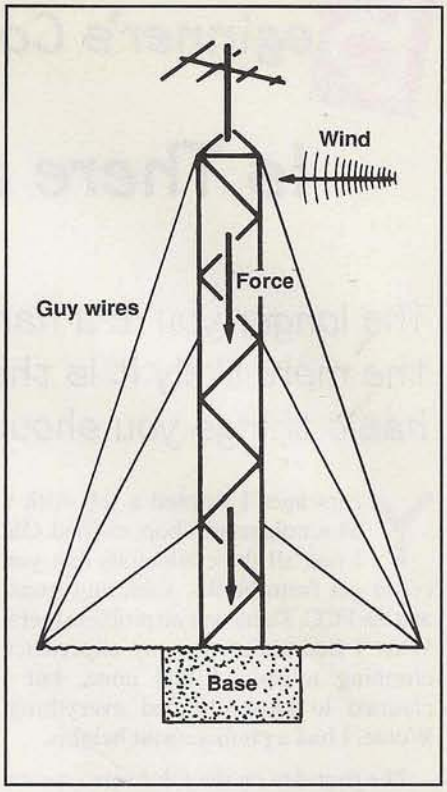


Figure 1. When wind hits a guyed tower, its energy is transformed into a downward force that is trying to push the tower into the ground.

On the other hand, the self-supporter (Figure 2) handles the wind energy in a completely different way. Here the tower is acting more like a lever, with the base being a pivot that doesn't move. The wind is attempting to "rotate" the base around in the ground. The tower is also storing some of the energy of the wind. As it flexes back and forth, it releases the stored energy. Waving back and forth is really a pretty good thing for the self-supporter, unlike its guyed cousin.

In either case, the base is a very important part of the tower. I've known a number of hams who took the attitude of "I'll just throw a couple of bags of ready-mix concrete in a hole and set the base on it."

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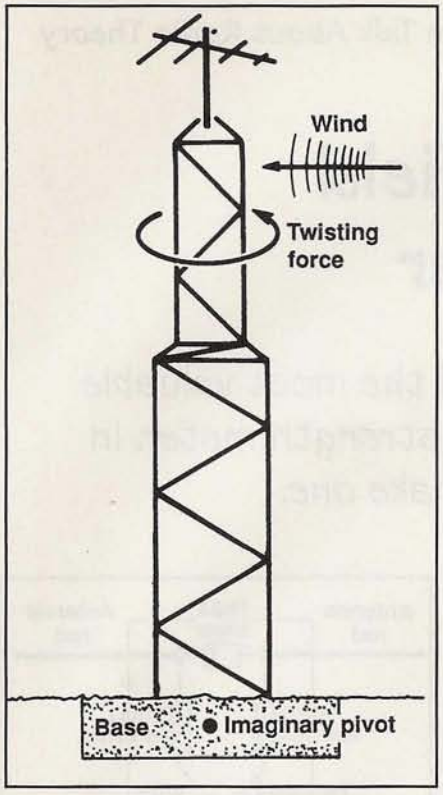

Figure 2. A self-supporting tower will (and should) sway in the wind. In this case, the force of the wind tries to twist the tower out of its concrete base.

Not smart, particularly if your soil is at all loose or sandy. When you buy your tower, the manufacturer provides you with drawings for the size and shape of the base. The taller the tower, the bigger the base, too. There are sound engineering reasons for these specifications, and you'd be wise to follow them closely.

Up on the Roof

There are two other variations of towers that probably should be mentioned here. (Personally, though, I don't care for either one.) First, there's the roof-top mounted tower, which can be either a self-supporting or guyed structure. It's cheaper than a full-blown tower, and some cities will allow you to put one up with few restrictions (I could have done so on Long Island with nothing more than a routine building permit). That's all well and good, but just keep this in mind: your roof has now become your base. Every time the wind blows, your antenna is either trying to shove the tower down through the top of your house or twist your roof off, depending on which style it is. Those thoughts just never appealed to me.

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If you're going to go to a roof-top installation, make sure your roof is sturdy and that it's not already overloaded with a second or third layer of roofing material. In fact, at my zoning hearing, one board member suggested I was wasting their time since I could put a roof tower up with only a building permit. The town engineer was there, so I asked him if they had an ordinance prohibiting more than two layers of roofing material on a house. He said they did because they didn't want the roof to collapse from the excess weight of the material, particularly with the potential for heavy snowstorms. I pointed out how a guyed tower worked and asked him if he thought there was a potential for high winds along with a heavy snowstorm. After that, there was no more mention of roof towers.

Getting Cranky

Another compromise form of tower is the crank-up or telescoping tower. This mechanical marvel uses steel cables and pulleys to raise and lower the antenna. In many ways, crank-up towers are a good idea. You can keep the antenna retracted most of the time and only raise it when you're going to use it. It may be a way of getting a tower in a neighborhood that otherwise would not permit one. Those are the good points.

There are two major drawbacks to them, as far as I'm concerned. First, crank-up towers tend to be really expensive. They may cost three or four times as much as a fixed-height tower. But what bothers me more is that from time to time, cables and pulleys have been known to break. Are they likely to break when the tower is retracted? Probably not; it would more likely happen when the tower is fully extended. Frequent inspection and proper maintenance is absolutely essential for these marvels. I wouldn't go near a crank-up except when it is fully retracted, and I especially wouldn't put a hand or foot on one that was at all extended. I'd like to keep all my toes and fingers.

Safety First

If you're going to climb a tower—*any* tower—you need a good safety belt. You can get one from vendors advertising in *CQ VHF* and *CQ*, or you can buy one locally from an industrial supply company. Check the yellow pages. It doesn't really matter all that much what style you buy, but you would be absolutely crazy to climb without one. Same goes for a hard-hat.

And so, there I was, glued to that tower 50 feet up in the air. I was running out of excuses for Dan. He knew something was wrong. It couldn't be taking me that long to catch my breath. Then something happened. I don't know how or why, but my pinkie finger on my left hand twitched. So, I started talking to it, telling it that it could move. And the next one moved, too. And the next one. Then my right hand started to move. So, I climbed on to the top and did the job I was there to do.

Sometimes you just start with the least little success and build on it. I never froze to a tower again. ■

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